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Diapause and the physiology of host-parasite synchronization in bupalus piniarius L. (geometridae) and Eucarcelia rutilla Vill. (Tachinidae)

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The following conclusions can be drawn. The parasite is apparently directly activated by the host, such activation occurring already during the period of endocrine activity preceding the host's adult development. The most feasible explanation is that a hormone is the activating substance. Most probably the prothoracic gland hormone functions as such. The endocrine activity of the host would therefore seem to be the key process in the mechanism synchronizing the life cycles of host and parasite.

XIV. SUMMARY

1. This study deals with the problem of synchronization of the life cycles of an insect parasite and its host. The relation between the Pine Looper, *Bupalus piniarius* L. (Lepidoptera, Geometridae) and its parasite *Eucarcelia rutilla* Vill. (Diptera, Tachinidae), attracted our special interest in this respect because the parasitized host has a pupal diapause. The first part of this report is concerned with this diapause, the second with an analysis of the synchronization mechanism.

2. During diapause of *Bupalus*, neurosecretory material is found to be produced in the medial neurosecretory cells of the brain. In contrast with the *Cecropia* silkworm, the brain shows spontaneous electrical activity.

3. During diapause, oxygen consumption is low and carbon dioxide is released discontinuously. The degree of stimulation of oxygen uptake by DNP injection is increased. Sensitivity to HCN is low (but this is also found in developing pupae). The activity of cytochrome-c-oxidase amounts to about 10% of the value found just before emergence.

4. Diapause is broken by chilling, by which treatment the brain becomes competent to release the brain hormone.

5. "Permanent" pupae are obtained by decerebration within one day after the pupal moult. Some symptoms of a partial resumption of development in these pupae are discussed.

6. Chilling also terminates diapause in the parasite. Similar sub-maximal chilling periods applied to parasitized and unparasitized pupae induce the start of development in a larger fraction of the parasites than they do in unparasitized pupae.

7. Synchronous activation of the host and parasite is maintained when development of the diapausing host is accelerated by parabiosis with a developing pupa. In the majority of cases, early decerebration of the host prevents development of the parasite. Removal of cephalon and prothorax of the host prevents development of both partners provided it is performed shortly after transfer to 25° C.